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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/694,465

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Gregg M. Gallatin

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EXAMINER

PATEL, SHAMBHAVI K

ART UNIT

PAPER NUMBER

2128

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

04/20/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

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Office Action Summary	Application No.	Applicant(s)	
	10/694,465	GALLATIN ET AL.	
	Examiner	Art Unit	
	Shambhavi Patel	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to the Amendment/Remarks submitted 22 January 2007.
2. Claims 1-33 are pending. Claims 31-33 are newly added.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 27 October 2003 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the Examiner has considered the IDS as to the merits.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. **Claims 31-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite** for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "outputting" in the last limitation in each of the above claims is indefinite. Does "outputting" refer to outputting a signal? A data file? Displaying the result on a screen?

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. **Claims 1-30 are rejected under 35 U.S.C. 101** because the claimed invention is directed to non-statutory subject matter. The Examiner asserts that the current state of the claim language is such that a reasonable interpretation of the claims would not result in any useful, concrete or tangible product. **Claims 1 and 26-27** are directed to generating a corrected phase map by performing model-based optical proximity correction. **Claims 21-33** are directed to performing model-based optical proximity correction on a VLSI layout mask. This claimed subject matter lacks a practical application of a judicial exception

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(law of nature, abstract idea, naturally occurring article/phenomenon) since it fails to produce a useful, concrete and tangible result. Specifically, the claimed subject matter does not produce a tangible result because the claimed subject matter fails to produce a result that is limited to having real world value rather than a result that may be interpreted to be abstract in nature as, for example, a thought, a computation, or manipulated data. More specifically, the claimed subject matter provides for generating a corrected phase map (**claims 1 and 26-27**) and outputting a corrected VLSI layout mask (**claims 31-33**). This produced result remains in the abstract and, thus, fails to achieve the required status of having real world value. All other claims are rejected by virtue of their dependency.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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6. Claim(s) 1-3, 20-21, and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baggenstoss (US Patent No. 6,374,396) in view of Neureuther (US Patent No. 7,030,997), in view of Fukuda ("Determination of High-Order Lens Aberration Using Phase/Amplitude Linear Algebra", 1999).

Regarding claims 1 and 27:

Baggenstoss discloses performing model-based optical proximity correction comprising:

- a. embedding wavefront information on a first two-dimensional complex array having a plurality of array elements and an assigned diameter (section 5 lines 38-40: Zernike coefficients (*wavefront information*) have x, y coordinates (2D))
- b. computing a point spread function (column 5 lines 36-37: Zernike polynomial (*point spread function*)). The function results from the wavefront data.
- c. performing optical proximity correction calculations using said point spread function (column 6 lines 5-15)

Baggenstoss does not explicitly disclose generating a phase map from the wavefront information. Neureuther teaches generating an initial and corrected phase map from the wavefront information (Neureuther: figure 31A). At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Baggenstoss and Neureuther because the method disclosed by Neureuther reduces the spillover effects that degrade the image quality with position within the field of die (Neureuther: background).

Baggenstoss does not explicitly disclose performing OPC calculations that account for *higher order aberrations* using the point spread function. Fukuda teaches a point spread function (Fukuda: section IV.A) that can be used to measure higher-order aberrations (Fukuda: Title, Abstract). At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the

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teachings of Baggenstoss, Neureuther and Fukuda because it is important to account for higher-order aberrations because they often affect imaging quality more seriously than low-order ones (**Fukuda: Introduction**).

Regarding claims 2 and 28:

The combination of Baggenstoss, Neureuther and Fukuda as applied to claim 1 above teaches embedding simulated wavefront information from randomly generated data (**Neureuther: figure 38; column 5 lines 6-9**).

Regarding claims 3 and 29:

Baggenstoss discloses claim 1 wherein embedding wavefront information comprises embedding empirically derived wavefront data (**column 5 line 42**).

Regarding claim 20:

Baggenstoss, Neureuther and Fukuda do not explicitly disclose reading the empirically derived wavefront in a row major order by substituting zero for ignored data and centering said empirically derived wavefront data. However, a skilled artisan would knowingly include this functionality in order to track what elements have been used and which ones remain unused.

Regarding claim 21:

Baggenstoss, Neureuther and Fukuda do not explicitly disclose obtaining a circle enclosing said empirically derived wavefront data; and embedding and centering said circle within a square array such that said circle has a diameter represented by an equal number of rows and columns of said array expressed as a value equal to 2 raised to the power of the log of the sum of said diameter plus one.

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However, a skilled artisan would knowingly implemented an array length of 2 raised to the power of the log of the sum of said diameter plus one because performing Fourier transformations on an array with a length = 2^v , will simplify the calculations. (this decimation can be performed $v = \log_2 N$ times. Thus the total number of complex multiplications is reduced to $(N/2)\log_2 N$).

7. **Claim 26 is rejected under 35 U.S.C. 103(a)** as being unpatentable over **Wong et al. (US Patent No. 6,223,139)** in view of **Fukuda ("Determination of High-Order Lens Aberration Using Phase/Amplitude Linear Algebra", 1999)**.

Regarding claim 26:

Wong discloses a method of performing model based optical proximity correction (**column 2 line 1**) on a lithographic mask pattern incorporating phase maps comprising: incorporating a point spread function array in real dimension (**column 3 lines 51-52: array analogous to the characteristic matrix in the prior art**) within a set of convolution kernels (**column 3 line 55**); and computing an aerial image with aberrations using said set of convolution kernels (**column 3 lines 52-57**). The characteristic matrix is inverted to obtain eigenvalues or eigenvectors, and these are convolved with the mask patters to form the aerial images. **Wong does not explicitly disclose** accounting for *higher order aberrations*. **Fukuda teaches** measuring higher-order aberrations (**Fukuda: Title, Abstract**). At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Wong and Fukuda because it is important to account for higher-order aberrations because the often affect imaging quality more seriously than low-order ones (**Fukuda: Introduction**).

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8. **Claims 31-33 are rejected under 35 U.S.C. 103(a)** as being unpatentable over **Neureuther (US Patent No. 7,030,997)**, in view of **Fukuda ("Determination of High-Order Lens Aberration Using Phase/Amplitude Linear Algebra", 1999)**.

Regarding claims 31-33:

Neureuther discloses:

- a. inputting an uncorrected VLSI layout mask (**abstract**).
- b. inputting a lithographic process model (**column 5 lines 48-67**)
- c. embedding wavefront information (**figure 11**) on a first two-dimensional complex array having a plurality of array elements (**column 17 lines 35-55: Zernike coefficients (wavefront information) have x, y coordinates (2D)) and an assigned diameter (column 7 lines 7-11)**)
- d. generating a phase map from said wavefront information (**figure 31A**)
- e. computing a point spread function (**column 20 lines 52-65**)
- f. performing said optical proximity correction on said uncorrected VLSI layout mask using said lithographic process model and outputting a corrected VLSI layout mask (**abstract**)

Neureuther does not explicitly disclose performing OPC calculations that account for *higher order aberrations* using the point spread function. **Fukuda teaches** a point spread function (**Fukuda: section IV.A**) that can be used to measure higher-order aberrations (**Fukuda: Title, Abstract**). At the time of the invention, it would have been obvious to one of ordinary skill in the art to combine the teachings of Neureuther and Fukuda because it is important to account for higher-order aberrations because they often affect imaging quality more seriously than low-order ones (**Fukuda: Introduction**).

Allowable Subject Matter

9. Claims 4-19, 22-25, and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims as well as overcoming the 101 rejection.

Examiner's Remarks

10. Examiner has cited particular columns and line numbers in the references applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings of the art and are applied to specific limitations within the individual claim, other passages and figures may apply as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references in their entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the Examiner.

In the case of amending the claimed invention, Applicant is respectfully requested to indicate the portion(s) of the specification which dictate(s) the structure relied on for proper interpretation and also to verify and ascertain the metes and bounds of the claimed invention.

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Conclusion


11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shambhavi Patel whose telephone number is (571) 272-5877. The examiner can normally be reached on Monday-Friday, 8:00 am – 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


KAMINI SHAH
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